

SNAKES AND LADDERS

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HISTORY AND INTRODUCTION

Word chains or ladders have been a source of challenge and enjoyment since their invention as "doublets" by Lewis Carroll over a century ago, in 1879. They were called Transformations by "Professor" Hofmann. Despite significant advances since Ross Eckler published his first study of word graphs (networks), there still remain challenges for those who relish hard work, and easier challenges for those seeking mere enjoyment. This article attempts to document the work published in Word Ways (and a few other places) over the years, presenting shorter solutions in most cases. It turns out that I was able to shorten so many that it seemed unhelpful to leave the reader to chase up one here, two more there and so on, so I have included all, except where noted. It also, both by examples and by reasoning, points out the relative difficulty of advancing in certain areas. The reader should therefore find it relatively easy to choose a challenge, knowing what has been done before, and having some idea of the difficulty involved; and likewise avoid the trivial. The number of examples published in the past has been legion, and I apologise if I have missed a few. Though it may not seem so to the casual observer, I have found the ladders more difficult to type accurately than the Ancient Greek, Cyrillic and mathematics that is routine to me, but I console myself that the reader will easily repair any errors (I would, however, be grateful to hear of them).

A word ladder is formed by taking two words of the same length, then attempting to change one into the other by changing a single letter at a time, always employing recognised words. The difficulty of doing this increases dramatically with the length of the word, as discussed in my "Statistics of Word Neighbours" (Word Ways November 1997), which was a direct result of my work on the ladders. To recap just one statistic, 99.5% of all 4-letter words can be changed into at least one other by a single letter change. (The corresponding percentages for 5-letter through 11-letter words are 97.5, 88, 71, 55, 42, 33, 28.) The 97.5% contradicts somewhat Borgmann's view that "any 5-letter word can be converted into any other one" (Word Ways February 1974), and lends qualified support to Leonard Gordon's "one can find a ladder between almost any 5-letter word pair" (February 1990 Word Ways). The tables following this article therefore give many examples of 4-letter ladders, but not one using words of 10 letters. It follows that the chal-

lenge for short words is only significant when further conditions are imposed. These conditions fall into two categories: technical, which has mainly to do with the letters, and semantic, which has to do with meanings. Indeed, one may reasonably impose both semantic and technical restrictions when searching for ladders composed of short words, but a reasonable challenge for long words may be to find a ladder of any sort. At about 7 letters, the reader will notice that many ladders use the same intermediates, due to the restricted choice; such ladders are really better presented as a graph.

MINIMAL AND IDEAL LADDERS

Examine the corresponding positions in the two terminal words: if the letters in n of those positions differ, then a minimum of n steps is required to change one word to the other. If that is managed, then I prefer to retain the normal English usage and say that it is a *minimal ladder*. If every corresponding position in the two terminal words has a different letter, then the ladder could also be called *ideal*, in which case the number of steps must equal the number of letters in the word. I stole the word 'ideal', with its definition, from Leonard Gordon (February 1989 Word Ways), but in his terminology, an ideal ladder is not to be called minimal. If all positions are different (which is desirable), but the ladder has more steps than the word has letters, Gordon calls it 'complete'. Thus in ALICE-SLICE-SLICK-SLACK-SNACK-SNARK, each position in the target word has a different letter from the corresponding position in the starting word, and the number of steps equals the number of letters, so I call this ladder ideal, implying minimal.

MODULES

An even stricter technical condition than ideal is that the letters should be changed in order from left to right. The resulting ordered ideal ladder was termed a *module* by Eckler and Gordon (May 1996 Word Ways, which see for a kit to make many 4-letter ladders such as JETS-LETS-LOTS-LOSS-LOST).

APPOSITE TERMINAL WORDS

We have already said that ladders are more interesting if the terminal words are apt or amusing, as in KILLER-COWPAT (try at your peril!). Such ladders appear in the listings Antonyms & Opposites and Related below, though they do not include the ladder ends such as MAKE-WORK, DOGS-BARK, FACE-LIFT and FOLD-HERE mentioned in the February 1996 Word Ways. BLACK-WHITE has been attempted by almost everyone from Carroll onwards, but it took seven steps until I did it (actually in many ways) with six headwords from the OED (May 1997 Kickshaws). The optimum was soon thereafter achieved by Jeff Grant (November 1997 Colloquy) by using one variant form. The listings below offer many such opportunities for improvement. WRONG-RIGHT has an interesting history: please refer to its entry. It is also true that a longer ladder between two given words may be acceptable to some (and certainly more appro-

priate for parlour games) if it uses common words, as opposed to a shorter ladder using obscure words.

TRANSPOSALS

However, there are further restrictions of a technical nature that make the ladder more interesting. The first of these is that the two end words should consist of a rearrangement of the same letters (especially if the rearrangement is apt, i.e. an anagram). A subset of these has each terminal word as the reverse of the other. The reversals actually appeared first (February 1979 Word Ways); Leonard Gordon introduced the more general transposals (February 1990 Word Ways). In turn, a subset of those has the whole ladder as a letter palindrome, in which case the ladder consists of reversal pairs of words, the central word being a palindrome in the case of words with an odd number of letters. A listing below is devoted to each of these three types--Reversals, Transposals other than Reversals, and Palindromic Ladders. R. Robinson Rowe (February 1979 Word Ways) imposed an extra condition for reversals which would have palindromes in the middle; he said the central letter must be changed, and changed back again, as in RAT-RUT-RUN-RAN-TAN-TAR instead of RAT-TAT-TAR. This is rather similar to decrying examples with an even number of words where the central two letters are the same (as in L00T-T00L).

REVERSIBLE HETEROGRAMS AS TERMINALS

A forthcoming article of mine presents a study of reversible heterograms. By this, I mean words with every letter different which form another word upon reversal. In this context, the object is to form a ladder between a heterogram and its reverse. The difficulty of this task may be gauged as follows. As reported in my article "Statistics of Word Neighbours" the percentage of words that are heterograms falls as the word length increases, at a rate far greater than the number of words increases (from 5 letters to 10 letters the percentage of heterogrammatic words falls from 61% to 6%). Their reversals are very unlikely to be words as word length increases, and the probability of forming ladders also decreases sharply with word length:

Word Length	Reversible Heterograms	No. of word pairs with shortest ladders	No. of word pairs with palindromic ladders
3	965	many	many
4	446	117 (length 4)	75
5	74	2(length 6), 7(length 7)	0
6	6	1(length 16)	0

The theoretical minimum ladder lengths are, respectively, 4, 4, 6 and 6. Notice that reversing a word with an odd number of letters takes one step fewer than the number of letters because the central letter is common. I found no reversible heterograms of length 8 or more, which

makes a 10-letter ladder of this type ever so much more difficult than a 10-square!

For 5-letter words, if a ladder exists, the central word must be palindromic, and the two end words are by definition mirrors of each other; therefore the ladder has a good chance of being palindromic. Actually, the 117 word pairs above have 430 minimum-length ladders between them, and most of the word pairs (75) have at least one palindromic ladder (actually 167 between them). These 75 are listed in the discussion of palindromic ladders in the following section. The 42 for which I found no palindromic ladders are listed below, and selected examples of the ladders are to be found in the Reversals listing. Remarkably, no minimal length ladder of 5-letter reversible heterograms has, to my knowledge, previously been published.

The largest number of ladders I found for a given 5-letter heterogrammatic word pair was 16 for RAGES (6 palindromic, 10 not), then 13 for NEVIR and NIVER (5,8), then 12 for LAMES (4,8), then 10 for SELAT, SALET and NOMAS (4,6). STRAP-PARTS was excluded for reasons other than flagellatory! The largest number of palindromic ladders for a given word were for RAGES (5), then NEVIR and NIVER (4).

The table above needs modification in the light of previously-reported work. For length 8, we can add the reversible heterogram SUALOCIN-NICOLAUS (a star and a forename) thanks to Dmitri Borgmann, who jocularly reported the existence of a ladder of more than 481 steps joining them! Regarding 7-letter ladders, Jeff Grant found one in 20 steps which I reduced to 16. LATIRUS, NILEVAR, SETIRON and ROTANEV appear to be isolanos, and ROTALID appears to be insufficiently well-connected. One of the 6-letter ladders with 6 steps had been found by Jeff Grant, the next best effort having 13 steps (which I reduced to 10). I have, however, discovered a word-phrase pair with 6 steps, and seven word pairs with just 7 steps. In the listing headed Reversals below, the single 7-letter and all the 6-letter ladders are printed, together with a selection of the 5-letter ladders.

The full list of 5-letter reversible heterograms with minimal length ladders for which I found no palindromic ladders follows. Some familiar words appear when you reverse the words given. Note that many words begin with DE- or RE-.

ASILE, CODEM, DELIS, DEMAN, DEMAS, DEMOS, DENYS, DERAT, DETAR, DEVOR, ELATS, EMITS, ENOWS, HALOS, LARUM, LATES, LIKES, LOGES, LYKES, NAMER, NAVIS, NEWAR, NITES, NOMES, NORIS, NOSER, NOTAR, PARTS, RACES, RAMES, REBAT, REBIT, REBUS, REBUT, RECIT, REMIT, REMYT, REPOT, RESAT, SEBAT, SERAT, SPROT

PALINDROMIC LADDERS

Jeremiah Farrell (August 1979 Word Ways) introduced palindromic ladders, which were reintroduced in 1991 by Dave Morice, Peter Newby and Leonard Gordon! A challenge was issued to find the longest such ladder, though some would disallow redundant steps such as TRAP-TRAM-TRAD. 5-letter palindromic ladders are relatively scarce. Some combinations of apt meaning and technical interest clearly pose more of a challenge, yet a challenge quite reasonable for short words. Referring back to the previous paragraphs, here are the heterogrammatic words I found with at least one palindromic ladder of the minimum length of 4 to their reversals (selected examples are given in the Palindromic Ladders listing). Note that many words begin with DE-, RE- or LA-.

AIRES, ANIMO, CIDAR, CIRES, CORAT, DALES, DAMON, DEKAN, DEMIT, DEVAL, DEVIL, DEVYR, DEWAR, DILOS, DORAS, FIRES, GABER, GNAWS, HALES, LAGER, LAMES, LANES, LAPES, LAPON, LARUS, LEDUR, LEVAN, LEVAR, LEVIN, LEVIR, LITES, LIVEN, LIVES, MALES, MANES, MELAS, MINEW, MURAS, NAGER, NAGUS, NARCS, NARKS, NEUIR, NEVIR, NIKER, NIPER, NIVER, NOMAR, NOMAS, NYKER, PEALS, PELAS, RAGES, RAKIS, RALES, RAMOS, RANET, RAPES, RATES, REALS, REDOS, RELIT, RELOT, REPAT, RETAS, REVIS, SALET, SCLAT, SELAT, SEMAT, SENAW, SENIT, SILAT, SINET, SYNET

STEPLADDERS

There have been a few other types of ladder suggested. Dave Morice proposed the stepladder (August and November 1989 Kickshaws, May 1991 Kickshaws), in which the replacement letter is restricted to the two letters adjacent to the original letter in the alphabet, as in MILD-MILE-MIME-NINE. Leonard Gordon (February 1992 Word Ways) felt this was too much of a restriction, and proposed that the replacement letter could lie six places away from the original letter, and that wrapping around the end of the alphabet be permitted, as in HAZE-HATE-BATE. This cunningly allows O to be swapped for I, O for U, and U for A.

ANAGRAMS AND SYNONYMS WITHIN THE LADDER

In 1892, Lewis Carroll invented the case where a step can sometimes be made by jumping to an anagram instead of replacing a letter, as in IRON-ICON=COIN-CORN-CORD-LORD-LOAD-LEAD, where the equals sign indicates the anagram step. More examples have been given by Leonard Gordon (November 1989 Word Ways). Being familiar with Carroll's numerical problems and their sometimes-dubious answers (and his vitriolic response to correction), I rather suspect this was merely an excuse for getting a result which he could not obtain in the conventional manner (though his example actually can be done conventionally in five steps). One could legitimise this by insisting, for example, upon alternation of letter substitution with anagramming (transposals). There is also the possibility of using synonyms rather than anagrams. We might perhaps describe these as alternating anagram and alternating synonym ladders.

Actually, I have just described what were introduced by Leonard Gordon as "stepwords", as in INCH-ITCH=CHIT-CHIS=ICHS-ICES=SICE-SIDE=DIES-DIEL-IDLE-ISLE. Other examples can be found in the February 1990 Word Ways.

JOINED LADDERS AND COMPLETE GRAPHS

If you can find two ladders, one starting with the same word that ends the other ladder, you can join the two ladders into one. Some examples of this are given in the listing of Joined Ladders below. A multiple example of this is Howard Richler's Ascent of Man (see list), in which six ladders of length one to five are joined, and all seven ladder start and end words are related in meaning. It would be interesting to see a fuller version that reflected evolution accurately (starting with bacteria = bug?). It is easy to generalise the idea to what might be called thematic ladders, such as types of conveyance. It may be that the start and end words will not only permit the ladders to join end-to-end but also in more ways. Some examples where a direct ladder exists between every chosen word are given in the listing Complete Graphs. For example, there are ten ladders joining WHEAT with FLOUR with DOUGH with BREAD with TOAST (but sadly not with BUTTER). When the ladders are of the ordered ideal type called modules, Gordon and Eckler use the term modular ladder for the object created when they are joined together; they also give a statistical description of how the type of 4-letter ladders called modules join (February 1996 Word Ways).

PANGRAMMATIC LADDERS

The August 1980 Answers and Solutions contains three examples of a ladder from WORD to QUIZ in 23 steps, using all the letters of the alphabet in the process. These are called *pangrammatic ladders*. Assuming you start with an n -letter word with all letters different, it follows that you will need at least another $(26-n)$ words; the examples therefore had the minimum number of steps. In a superior version of this, the last word links back to the first. In the May 1990 Word Ways, Leonard Gordon quoted such a circular example, of necessity having 26 steps, due to Ross Eckler: MAZE-FAZE-GAZE-GAVE-WAVE-WAVY-WAXY-WARY-WARN-WAIN-WHIN-SHIN-SHIT-SUIT-QUIT-DUIT-DUCT-DUCE-DUPE-JUPE-JUKE-JOKE-JAKE-BAKE-BALE-MALE. He also gave some 5-letter non-circular examples beginning with FAQIR, and issued a challenge to find circular pangrammatic ladders for 5- and 6-letter words.

GARBLE GROUPS

Garble groups present a powerful way of generating word ladders. Rudolph Castown (August 1968 Word Ways) gave an example of what came to be called a (2 2 2 2) garble group. This means a 4-letter word with two possible letters for each position, any combination making a proper word. His example was S/P, I/A, N/T, S/E. There are $4 \times 4 = 16$ words in all, and there are $4! = 24$ routes or ladders starting from any one word (384 ladders in all). He also gave the 3-letter example P/P, A/I, N/T, a

(2 2 2) group with 8 words and 6 ladders each, making 48 ladders. Magic! I know of no such 5-letter example (all letters change).

CONCURRENT NUMERICAL PROPERTIES

Four-letter word ladders are so easy that we might ask that the words also have a numerical link, spelling out the age of Cleopatra's nose, or being multiples of the same number, or occupying all the prime-numbered positions in prime-numbered pages in the MWPD...

SNAKES

In listings below, I add snakes which return us whence the ladder took us. Where there is an extraordinary number of possibilities, I note it. The ideal snake has every word different from the ladder, as in COLD-HEAT, below.

WORD STAIRS AND SYNONYM CHAINS

Related to ladders are strings of letters that reveal another word every time a window is slid one position further along the string: if we use a window of length three, SPALATEA (of necessity a concatenation of 3-letter words) gives SPA, PAL, ALE... TEA. This example is cited in Dudeney's 300 Best Word Puzzles; he called them word stairs since you can arrange the words vertically, offsetting each by one letter to form a staircase. The record for Webster's Second Edition stands at 437, by Tom Pulliam (May 1979 Word Ways).

In a suggestion parallel to that of word ladders, Dmitri Borgmann also introduced synonym chains, in which a succession of synonyms leads eventually to the opposite of the initial word, as in BLACK-DARK-OBSCURE-HIDDEN-CONCEALED-SNUG-COMFORTABLE-EASY-SIMPLE-PURE-WHITE. This trick makes use of multiple meanings of single words.

LADDERS OF MAXIMUM LENGTH

One type of ladder is not often seen, and that is the *longest ladder* for words of a given length. There is obviously a choice between the longest possible ladder, and the longest ladder that cannot be shortened. Both, however, are subject to losing their status with quite small changes in vocabulary.

EASE OF LETTER SUBSTITUTION

Dmitri Borgmann once said that substituting V for U (VALUE-VALVE, MOUE-MOVE) was very difficult (though it is easy if we allow older and newer forms of the same word, like UESSEL-VESSEL). Figure 42c of *Making the Alphabet Dance* looks at letter substitution in general, and suggests Q is the most difficult letter. On page 103 it is both argued and demonstrated that it is much easier to transform one word into another if both have the same pattern of vowels and consonants, such

as CCVC. In theory, it might be possible to have a ladder that uses all combinations from, for example, CCCC to VVVV, but that is not possible for words of length four or more using solely the Official Scrabble Players Dictionary.

VARIATION OF SPAN LENGTH AND PERCENTAGE OF ISOLANOS WITH WORD LENGTH

If we take all pairs of words of a given length, and write down the lengths of the shortest ladders between them, then the longest such ladder is called the span of the graph of the words of that length. As one's vocabulary increases, there is the possibility that the new words will make possible a shorter path between the two words involved (indeed, this seems very likely, as the span seems to travel through a very popular region, where new words are quite likely to go); and also the possibility of creating a new span between two other words. From the few points of comparison (maybe someone can fill in the blanks), it seems that spans increase with vocabulary. The table below sets out the spans corresponding to four different vocabularies, lending some credence to the idea that span increases with vocabulary. (The terminal words in most of these spans are listed following the table.) Shortening of the span with a larger vocabulary is illustrated in the last row (labeled Current Length); for example, I have been able to do PAINCH-DEGAGE in 11 steps instead of 40. These figures do not mean the spans are necessarily that much shorter, since another sequence may now have become the span. Most of the ladders concerned appear later, in the main listings. Here are the reported spans:

Word Length	3	4	5	6	7	8	9
MWPD (Aug 1973)	12			30			
OSPD (Feb 1989)		14	29	40			
OSPD+ (Aug 1990)					59	25	
OSPD+Web2 (Nov 1995)						73	29
Current Length		4-6	10	11	22	45	29

MWPD: GIGGLY-SUDDEN (9 with reduced vocab.)
 OSPD: INCH-ISLE/ORLE/AMYL JENRO-IDLER PAINCH-DEGAGE
 OSPD+: ANLAGEN-CABARET BERTHING-QUIRKING (17 with larger vocab.)
 OSPD+Web2: RURALITY-DEAFNESS UNPAUSING-UNDERLOUT

At the same time, the percentage of isolanos hardly seems to change as vocabulary increases, as the following table shows (e=estimated):

Word Length	4	5	6	7	8	9	10	11
MWPD		27e	39e	60e	81e			
OSPD	1.9							
OSPD+Web2					44.8	57.3		
My Words	0.5	2.6	11.7	28.6	44.8	57.9	66.2	72.2

After 9-letter words, the actual number of words decreases, and the percentages of isolanos rises, though even this squeeze does not in my view explain how fast the degree of difficulty of finding ladders increases.

AN INTERMEDIATE WORD MUST HAVE TWO VOWELS?

Now for a brief digression. It should already be clear that 4-letter ladders need something special to justify spending time on, but there is an internal technical matter that may be of interest. Start with the facts that 46% of 4-letter words have one of the letters AEIOU, and 47% have two. It is therefore quite likely that both terminal words in a ladder will have one vowel. Suppose these vowels are in different positions. Then at least one of the intermediate words must have two vowels, unless you manage to use one of the 3.5% of 4-letter words which have no AEIOU. The reason is that you must preserve at least one vowel at all times (most probably), so you must add the second vowel before removing the first. Clearly this argument can be extended in various ways, but this is a descriptive article, not a theoretical one.

FOUR IS EASY

In order to emphasise how special 4-letter ladders need to be to merit attention, just write a story such as the one we call "Laddered Silk":

TAKE the LEAF CROP from each mulberry BUSH or TREE. CHOP it. Each GRUB or WORM kept in a WARM TRAY over a FIRE, EATS the leaves, and will SPIN a cocoon containing a PUPA. Let some develop into a MOTH, which will MATE, MALE with female, producing EGGS or SEED to repeat this TALE. Boil the others, unraveling the SILK thread, taking several ends, and REEL them together. Combine to make YARN. When this is DYED, SELL it to someone with a DRAW LOOM. They will weave WARP and WEFT (or WOOF, each with its own SHED), to make cloth for a beautiful COPE, HOSE, VEIL or even SAIL.

One should usually expect to be able to make a long ladder, containing each of the capitalised words in a relevant order, or perhaps a network connecting all the words. I have not done this because of the number of logical paths possible, and the space required to display the results. However, a main line (not included in the lists below) is SEED-weed-wood-word-WORM-wore-pore-pope-pupe-PUPA-puta-muta-mota-MOTH.

LADDERS -- A CHALLENGE AT ALL LEVELS

Laddering challenges for both neophyte and expert abound. Many of the solutions below are not minimal. There is only one example of ladders for words of length nine or more. Palindromic ladders are in short supply, as are other restricted types, including thematic ladders and complete graphs. SPRING-SUMMER-WINTER is crying out to have AUTUMN added, and AUTUMN is not an isolano. ECKLER is tough (ladder-

wise)! I hope the reader will browse; there should be examples for all tastes (including those still seeking to turn base metals into precious).

ACKNOWLEDGEMENT

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Description of Listings

The listings that follow are alphabetic within word length within category. The notation 5,7 means that the shortest conceivable ladder need have only 5 steps, but the shortest to date is 7. When the shortest has been achieved, this is indicated by an asterisk: 5*. The original publication is indicated next, with the number of steps then taken. If this number equals the one indicated as the shortest, the ladder given in the publication then follows. If no reference is given, the idea is mine (BREAST-STROKE), and if the shortest is less than any number of steps quoted, the ladder is mine. All snakes are mine. For example, HARD-EASY is annotated 3*, meaning that it requires a minimum of 3 steps, and this has been achieved (and it was not too hard!). I first encountered it in Leonard Gordon's article W90-022, where it was done in 4 steps (oddly quoted as the minimum, as with HAIR-BALD). Reasons of space prohibit inclusion of original ladders that are no longer the shortest.

Words in this article come from the Oxford English Dictionary (OED), Webster's Second Edition (Web2), the Official Scrabble Players Dictionary (OSPD), or Stedman's Medical Dictionary, except when otherwise noted. Borgmann's Language on Vacation is coded LoV; the 1903 edition of the Encyclopedia Britannica is coded EB. Other sources include Ian Stewart's Nature's Numbers (Orion, London, 1995), Willard R Espy's *The Game of Words* (1971), Hofmann's *Puzzles Old and New* (Frederick Warne, London, 1893; republished and edited by L E Hordern in 1993), and H Dudeney's *300 Best Word Puzzles* (The Daily News, London, 1925; republished by Scribner's in 1968). vf is a variant form in the OED, and ? is unknown.

Antonyms & Opposites

COLD—HEAT	4*	W90-022 4: hold—held—head—HEAT—helt—celt—colt
GOOD—EVIL	4, 6	Borgmann (LoV) 13, W89-226 9/10: goon—goin—grin—Erin (NY)—evin—EVIL—ovil—Ovid—oid—boid—bood
HAIR—BALD	3*	W90-022 4: haid—hald—BALD—baid—bair
HARD—EASY	3*	Hofmann 5, W90-022 4: hary—eary—EASY—eary—eard
HATE—LOVE	3*	Hofmann 3: have—lave—LOVE—lave—late
HEAD—TAIL	4*	Carroll 5 W89-223 4: heal—heil—hail—TAIL—hail—haid—heid
HEAD—TOES	4*	W90-022 4: heed—hoed—hoses (koes in original)—TOES—tees—teas—tead
LIFT—DROP	4, 5	fift—fiot?—frot—drot
MORE—LESS	4*	Hofmann 4: lore—lose—loss—LESS—mess—moss—mors
POOR—RICH	4, 5	Carroll 6, W90-092 5: pook—rook—rock—rick—RICH—rish—pish—posh—pooh
WARM—COLD	4*	W79-45: ward—word—cord—COLD—cald—wald—walm

ABOVE—BELOW	5, 8	W74-63 "taking only nine steps to achieve the allegedly impossible" 9, including village names etc.: abave—awave—swave—seave—selve—belve—beloe (vf)—BELOW—berow—beroe—berne—terne—teone—T-bone—abone
ABOVE—UNDER	5, 8	abode—anode—anole—ankle—anke—anker—unker—UNDER—undee—undye—uneye—aney—abeye—abaye—abave
ALICE—SNARK	5*	W91-223 5: slice—slick—slack—snack—SNARK—snare—slare—alare—alace
ANGEL—DEMON	5, 7	W90-023 11: anger—aeger—meger—memer—demer—demor—DEMON—lemon—legon?—legen—leger—aeger—anger
ANGEL—DEVIL	4, 7	anger—aeger—neger—never—nevir—nevil—DEVIL—devel—revel—rivel—risel—aisel—Ansel (lager)
ANGEL—SATAN	5, 7	anger—aeger—seger—sager—sagar—sagan—SATAN—saten—eaten—eater—enter—anter—anger
BLACK—WHITE	5*	Carroll 7, Gooch W97-134 6, Grant W97-270: blace (vf)—blate—wlate—whate—WHITE—wlate—blite—blate—blace (vf)
BLIND—SIGHT	5, 7	W90-023 12: blend—biend—biens—siens—signs—sighs
CHAOS—ORDER	5, 9	chans—chins—crins—cries—aries—artes—arter—orter—ORDER—ouder—tuder—teder—teaer—thaer—chaer—chaar—chaas
FAIRY—WITCH	5, 7	farry—farcy—parcy—parch—patch—pitch—WITCH—watch—latch—laich—laics—lairs—fairs
LARGE—SMALL	5, 6	sarge—saage—saale—shale—shall—SMALL—stall—stale—saale—saage—sarge
SOBER—DRUNK	5, 7	W68-026 18, W68-239 9 (Francis): sower—dower—dowee—downe—downk—dounk—DRUNK—dounk—doun—dorne—doree—soree—sorer
SOBER—OILED	4*	soler—siler—oiler—OILED—siled—soled—soler
TEARS—SMILE	5*	Carroll 6: sears—seare—seire—seile—SMILE—seile—seils—seals—sears
WRONG—RIGHT	5, 7	Dudeney 20, Borgmann 17/19, W68-026 in 9 but personal names, W89-225 13: drong—drone—dione—digne—rigne—righe
BROKEN—MENED	5, 6	W90-024 8: braken—braked—beaked—beaded—bended
PAUPER—RICHES	5, 7	W90-024 8: pauser—passer—pisser—pisher—picher—richer—RICHES—raches—rashes—rasher—rasper—ramper—pamper
SUMMER—WINTER	4, 5	Carroll 14, W89-225 6: sumner—sunner—sinner—sinter—WINTER—sinter—sister—suster—sumter (vf)

Palindromic ladders

Redundant words, in which the same position is changed twice in succession, are enclosed in square brackets: [].

BRAG—GARB	4, 16	W91-95 16: brad—trad—[tram]—trap—trop—[trow]—trot—toot—tort—[wort]—port—part—[mart]—dart—darb (non-palindromic in 5, see below)
DACE—ECAD	4, 20	W91-94 20 This ladder can continue split at SEEP on the way to ESSE for a total length of 30; or it can split at SALP to continue to BOOB for a total length of 30; and other possibilities: dage—rage—raga—saga—sala—salp—saip—seip—seep—sees—pees—pies—pias—plas—alas—agas—agar—egar—egad (non-palindromic in 5: daae?—saae—saad—scad)
DORT—TROD	4*	W91-045 4: tort—toot—trot—TROD—tood—tord—tort
FLOG—GOLF	4, 14	W79-151 14: flow—flew—slew—stew—step—seep—sees—pees—pets—wets—wels—welf—wolf (non-palindromic in 5, see below)
GUNS—SNUG	4, 10	W91-046 10: gins—pins—pies—pees—peep—seep—seip—snip—snig (non-palindromic in 5: suns—suus (vf)—suum—snum)
MILS—SLIM	4, 22	W91-095 22: tils—tins—tons—wons—wots—wets—pets—pees—[lees]—[dees]—sees—[seed]—[seel]—seep—step—stew—stow—snow—snot—snit—slit (non-palindromic in 5: mels—sels—selm—seim—SLIM—seim—seis—meis—mels)
PETS—STEP	4*	W91-046 3: pees—sees—seep
SORE—EROS	4, 12	W91-046 12: sare—sart—part—port—tort—toot—trot—trop—trap—tras—eras (non-palindromic in 5: sire—eire (vf or country)—eirs—errs)
STAR—RATS	4, 6	W91-046 6: sear—seer—sees—rees—raes (non-palindromic in 4: stas (vf)—rtas (Web3)—raas

TEEM—MEET	2, 4	W91-046 4: deem—deed—meed (non-palindromic in 3: teet—feet)
TRAM—MART	4, 8	W79-151 8: trap—trop—trot—toot—tort—port—part (non-palindromic in 4: trat—taat—tart)
WORD—DROW	4, 16	W91-045 16: ward—pard—part—[mart]—dart—dort—tort—toot—trot—trod—trad—[tram]—trap—drap—draw (non-palindromic in 5: wood—pood—prod—prow)
DEVIL—LIVED	4*	devel—level—leved—LIVED—leved—deved (Eng Dial D)—devel
DILOS—SOLID	4*	dolos—dolod (Ngarinjin)—solod—SOLID—solod—solos—dolos
DIMIT—TIMID	2, 14	W91-96 14: demit—remit—relit—relet—reles—redes—sedes—seder—seler—teler—tiler—timer—timed (non-palindromic in 2: timit)
FIRES—SERIF	4*	sires—siris—seris
KNUTS—STUNK	4, 16	W91-96 16: [knits]—knats—gnats—gnaws—snaws—staws—stows—stots—swots—swats—swans—swang—stang—stank—[stink] (non-palindromic in 5: knubs—snubs—stubs—stuns)
LAGER—REGAL	4*	rager—Rager (town, Missouri)—regar (Chambers 1990)—REGAL—regar—Ragar (Surname Denver)—rager
LEPER—REPEL	2, 4	W91-96: lever—level—revel (or lower—rewer—rewel, or non-palindromically in same number of steps)
LIVEN—NEVIL	4*	leven—level—nevel—NEVIL—nevel—neven—leven
LOOPS—SPOOL	4, 22	W79-151 22: loots—poots—ports—parts—darts—dirts—diras—doras—soras—sodas—sadas—sados—saros—sarod—sarid—strid—strad—strap—strop—stoop—stool (non-palindromic in 6, see below)
MALES—SELAM	4*	sales—seles—selas (W93-031)—SELAM—selas—salas—sales
RAGES—SEGAR	4*	ragas—sagas—sagar—SEGAR—seger—seges (vf)—reges
REPAT—TAPER	4*	repar—reper(vf)—raper—TAPER—tapet—tepet—tepat
Reversals		
ABUT—TUBA	4, 5	W80-123 13: abue—abbe—aube—tube
AVID—DIVA	4, 6	W80-123 12: avie—aeie—deie—deve—dive—DIVA—divs—dies—gies (vf)—aves—avis
BARD—DRAB	4*	W80-122 8: baad—brad—brab—DRAB—drad—brad—baad
BRAG—GARB	4, 5	W80-122 8: bras—baas—bars—gars—GARB—barb—barn—baan—bran
DIAL—LAID	4, 5	W80-122 6: deal—dead—lead—laad—LAID—lard—dard—dird—diad (and 20 others!)
DRAY—YARD	4, 5	W80-122 7: bray—brad—baad—bard—YARD—yird—dird—diad—drad
DUAL—LAUD	4, 5	W80-122 7, W82-016 5: deal—dead—lead—leud—LAUD—baud—baul—baal—bual
FLOG—GOLF	4, 5	W79-045 7, W82-016 5: flop—glop—goop—goof—GOLF—gold—fold—food—flod
FLOW—WOLF	4, 5	W80-123 8: glow—glof—goof—woof—WOLF—wolt—woot—foot—flot
GIRT—TRIG	4, 5	W80-123 12: gart—gait—gaig—grig—TRIG—grig—geig—geit—gert
GNAT—TANG	4, 5	W80-122 6 W82-016 5: geat—gent—gant—gang—TANG—taig—gaig—gait—gnit
GNUS—SUNG	4, 5	W81-90 7: gaus—gaug—gang—sang—SUNG—suns—sans—saus—gaus
GULP—PLUG	4, 5	W80-123 10: golp—goup—poup—plup—PLUG—glug—gaug—gaup—galp
LAIR—RIAL	4, 5	W80-122 7: rair—rail—rall—rill—RIAL—tial—tiar—liar—laar
PART—TRAP	4*	W80-122 6: tart—taat—trat
SNAP—PANS	4, 5	W81-90 9: saap—samp—pamp—pams—PANS—sans—sand—saad—saap (and 26 others)
SNUG—GUNS	4, 5	W81-90 11: snum—suum—suus—suns—GUNS—gins—ging—sing—siug?
SPAR—RAPS	4, 5	W81-90 7: sear—seas—seps—saps—RAPS—maps—maas—maar—saar (and 31 others!)
SPAT—TAPS	4*	W80-122 8, W82-016 5: saat—sapt—saps—TAPS—tapt—taat—saat
SPIT—TIPS	4, 5	W81-90 6: suit—suis—tuis—tups—TIPS—tops—sops—sopt—soit
SPOT—TOPS	4*	W80-123 6: soot—sopt—sops—TOPS—topt—toot—soot
SWAY—YAWS	4, 5	W80-123 11: swap—saap—yaap—yawp—YAWS—yews—sews—seas—seay
TRAM—MART	4*	W79-45 6: trat—taat (EDD)—tart—MART—maat—taat—trat
TROW—WORT	4*	W80-123 4: trot—toot—tort—WORT—woot—wrot—trot

DEMAN(vf)—NAMED	4*	daman—(rock-badger)—damad (Ali, Encylo Britt)—damed (vf, verb dame)—NAMED—namen—naman—daman
DETAR—RATED	4*	deter—dater—dated—RATED—rater—dater—deter
KNAPS—SPANK	4, 5	W90-023 5: snaps—swaps—swans—spans—SPANK—spark—snark—knark—knars
LIKES—SEKIL	4*	sikes—sikel—sikel—SEKIL—sikel—sikus (Dict Archaic)—sikes
LOOPS—SPOOL	4, 6	W79-045 12: coops—chops—shops—shoos—shool
REBUT—TUBER	4*	rebet—Reber (Fr composer)—ruber
REPOT—TOPER	4*	repet—reper—roper—TOPER—topet—tepet—repet
SPROT—TORPS	4*	tprot—to-rot—toros
TRIPS—SPIRT	4, 6	W90-023 7: crips—clips—clipt—slipt—slirt—SPIRT—shirt—thirt—thirs—thigs—trigs
DECART—TRACED	6, 11	W80-84 17 (Tom Pulliam): decast—becast—beeast—breast—breist—treist—traist—traiss—traies—traces—TRACED—tracer—bracer—brawer—brewer—brewet—brewst—breast—beeast—becast—decast
DENIAL—LAINED	6, 7	(Lained from verb lain): penial—panial—pannal—pannel—panned—pained
HAIREN—NERIAH	6, 10	W80-084 13 (Tom Pulliam): Dairen (see original)—Darren—carren—carien—carian—Marian—Morian—Moriah (see original)—meriah
LANRET—TERNAL	6, 7	langet—larget—target—targat—tergat—tergal
LARDET—TEDRAL?	6, 7	larget—target—targat—tergat—tergal—terral
LETSON—NOSTEL	6*	(he lets on, phrase): lesson—lessen—Lessel (London surname)—lossel—nossel—NOSTEL—nossel—nossen—lossen—lessen—lesson
LEUMAS?—SAMUEL	6, 7	lemmas—lammas—cammas—cammes—cammel—sammel—SAMUEL—sambel—sambal—sambas—sammass (tribe, India)—lammas—lemmas
NITRAS—SARTIN	6, 7	nitran—nitron—natron—satron—satton—sattin
NOSIER—REISON	6, 7	rosier—rosser—rossen—roasen—reasen—reason—REISON—reison etc
RECLUS—SULCER	6, 7	recles—reales—realer—Reller (surname, Manhattan)—ruller—suller—SULCER—suller—seller—reller—realer—reales—recles
RECAPS—SPACER	6, 12	W90-023 14: remaps—remans—remand—remind—remied?—retied—retted—setted—seated—spated—spaced—SPACER—sparer—searer—rearer—reared—reased—remised?—remied?—remind—remand—remans—remaps
REKNIT—TINKER	6*	W80-084 6 (Jeff Grant): rennit—rennet—renner—tenner—tinner—TINKER—tinner—tinnet—rinnet—rennet—rennit
REPAID—DIAPER	6, 10	W90-023 13: repand—repnd—resend—reseed—rested—rester—dester—dister—disper
REPINS—SNIPER	6, 11	W90-023 15: rewins—sewins—serins—series—serves—server—seaver—swaver—swiver—swiper—SNIPER—sniter—snater—seater—sester—rester—rested—reseed—resend—repnd—repens
SPACED—DECAPS	6, 12	W80-84 25 (Dmitri Borgmann): spaned—seaned (vf)—deaned—dennd—denied—denies—demies—demiss—demess—decess—decass—DECAPS—recaps—remaps—remans—remand—remind—remied?—remised?—reased—reared—seared—spared
REKNITS—STINKER	6, 16	W80-084 21 (Jeff Grant): rennits—rennets—renners—renders—readers—rearers—roarers—soarers—starers—starees—starves—starver—starker—stacker—sticker
SUALOCIN—NICOLAUS	8, >>481	W80-84 (Dmitri Borgmann): mystery not revealed!

Transposals other than reversals

RAJA—AJAR	4, 7	W90-023 9: raka—aaka (NZ)—alka (seltzer?)—alky—alay—alar—AJAR—alar—alas—aaas?—aaaa (Tahitian interjection)—faaa (place, Tahiti)—faja
SNUG—GNUS	3*	anug?—anus
CHEAT—TEACH	5, 6	W90-023 9: theat—theak—theck—thack—thach
EARTH—HEART	5, 6	harth—harte—haate—haare—heare—HEART—hears—heats—heath—herth—harth
ESTER—TERSE	5, 6	W90-023 9: eater—tater—tarer—taree—tarse
LAGER—REGAL	4*	leger—legar—legal—REGAL—regar?—legar—leger
LARGE—REGAL	5, 6	W90-023 8: lange—lanae—ranae—ranal—renal
PORTS—SPORT	5*	W90-023 6: poots—poors?—poort—soort
STOUT—TOUTS	5*	W90-023 6: stott—stots—soots—toots

LISTEN—TINSEL	4*	linten—lintel—linsel—TINSEL—linsel—lintel—listel
SILENT—LISTEN	5,9	silens (vf)—sirens—sirees—sirtes—sixtes—sixter—sister—lister
SILENT—TINSEL	5,11	silens (vf)—sirens—sirees—sarees—marees—marces—marcel—tarcel—tancel—tansel—TINSEL—linsel—lintel—linter—sinter—sixter—sixtes—sirtes—sirees—sirens—silens (vf)
CHEATER—TEACHER	5, 7	W90-024 12: cheeter—cheeker—checker—chacker—thacker—thacher
Related		
CAT—DOG	3*	Hofmann: cot—cog—DOG—dot—dat
SIN—WOE	3*	Hoffmann: son—won—WOE—won—win
ARMY—NAVY	3, 6	Carroll 8, W90-92 7: arry—aery—wery—wary—wavy—NAVY—nany—nane—ane—arne—arme (and 40 more!)
BEAU—LOVE	4, 5	W90-023 6: belu—bele—lele—leve—LOVE—bove—bode—bede—bedu
BEER—PISS	4*	W90-022 4: peer—pees!—pies—PISS—biss—bies—bees
BLUE—GRAY	4*	W90-022 4: blae—brae—bray—GRAY—gruy?—grue—glue
BLUE—GREY	4*	W90-022 4: glue—glee—gley—GREY—brey—bley—blee
BLUE—PINK	4, 5	Carroll 9, Hofmann's editor 7, W90-92 6, W91-082 5: slue—siue—sine—pine—PINK—bink—bine—bone—boue
CALL—GIRL	3*	gall—gill—GIRL—cirl—cill
COLD—MIST	4*	W97-56 4: mold—mild—milt—MIST—most—cost—colt
COMB—HAIR	4, 5	Carroll 7, W91-082 5: come—came—hame—haie—HAIR—hoir—hois—cois—coms
FOOT—MILE	4*	W90-022 4: moot—molt—mole—MILE—file—fole—folt
FOOT—YARD	4*	W90-022 4: fort—ford—fard—YARD—fard—ford—food
FOUR—FIVE	3, 4	Carroll 7, W89-224 6, W90-92 5: faur—faue—fave
GRUB—MOTH	4, 6	Carroll 9, W89-224 6: grab—grat—goat—moat—mott—MOTH—math—mate—gate—gaue—gaub (46 others)
HAND—FOOT	4*	Hofmann 6, Newby 89-225 5, W90-92 4: fand—fond—font—FOOT—hoot—hood—hond
HARE—SOUP	4,*	Carroll 7, W89-224 5, W91-82 4: hore—sore—soue—SOUP—houp—houe—hore
HOOK—FISH	4, 5	Carroll 5: hoot—host—hist—fist—FISH—fosh—posh—pooh—pook
INCH—FOOT	4, 6	ino—inou—knou—knot—koot—FOOT—soot—snot—ynot—ynoh—ino
INCH—MILE	4, 5	ench—eich—mich—mice
INCH—YARD	4, 5	ynch—yach—yack—yark
IRON—LEAD	4, 5	Carroll "alternating anagrams" 7: aron—aeon—leon—lean—LEAD—bead—bean—beon
IRON—GOLD	4, 5	tron—trod—tood—good—GOLD—golk—gook—grok—irok
LEAD—GOLD	3*	load—goad
LION—LAMB	3*	Carroll 3: limn—limb
LOAF—OVEN	4, 5	Carroll 10, W89-224 8, W91-082 7: loan—eoan—evan (vf)—even
LOVE—LUST	3*	luve—luse—LUST—lost—lose
MANY—FAIL	3, 4	Carroll 8, W89-224 5: mary—marl—mail—FAIL—faie—fane—Fany (= FANY)
MINE—COAL	4, 5	Carroll 6, W91-082 5: cine—cone—cont—coat—COAL—moal—moul—moue—mone (and 25 others)
MIST—RAIN	4*	W97-056 4: mast—mait—main—RAIN—rait—rast—mast
NOSE—CHIN	4, 5	Carroll 6, W89-224 5: none—cone—conn—coin—CHIN—cain—nain—naie—nase
NOSE—DRIP	4, 5	bose—boie—brie—drie—DRIP—drup—doup—noup—noue
NOSE—PICK	4*	pose—pise—pice—PICK—nick—nice—nise
ODDS—ENDS	2, 3	W90-023 3: adds—ands—ENDS—elds—olds
PITY—GOOD	4, 5	Carroll 7, W89-224 5: piny—pony—pond—pood—GOOD—gold—pold—pild—pily
REST—SOFA	4, 5	Carroll 5: lest—lost—loft—soft—SOFA—sora—sort—rort—rert
ROSE—LILY	4*	Hofmann 5: rise—rile—lile—LILY—rily—roly—role
SHIP—DOCK	4*	Ian Stewart 8: shik?—soik—sock
SHOE—BOOT	3*	Hofmann 3: shot—soot

SHOP—LIFT	4*	shot—siot—sift
SICK—WELL	4*	silk—wilk—will—WELL—sell—selk—seck
SWAN—SONG	3, 4	W90-022 4, but in error: saan—sann—sang—SONG—sony (= sunny)—soay—sway
TOWN—CITY	4, 5	W90-023 6: tows—tots—tits—cits—CITY—civy—covy—cowy—tow
TREE—WOOD	4*	Carroll 8, W89-224 6, W90-92 5, W91-082 4: tred—toed—wood—WOOD—tood—trod—tred
WOOD—COAL	3*	Hofmann 3: wool—cool—COAL—coad—woad
WOOL—YARN	4*	W90-023 5: woon—worn—warn—YARN—yarl—warl—worl
WORD—TALE	4*	W93-048 4: ward—ware—tare—TALE—tald—told!—tord
YARD—MILE	4*	W90-022 4: yare—mare—male—MILE—male—yale—yald
AGAIN—CHAIN!	3*	arain—crain
BANJO—SITAR	5, 7	W90-023 11: bango—bange—binge—singe—sinae—sitae?
BEANS—SHELF	5, 6	Carroll 8: beals—beale—beeel—seele—shele—SHELF—shelt—shent—shant—seant—beant
BILLY—GOATS	5*	W90-022 5: bills—bolls—bolts—boats—GOATS—goaty—boaty—bolty—bolly
BOOKS—GRADE	5*	W90-022 5: gooks—goods—goads—grads—GRADE—brade—brads—brods—boods
BREAD—TOAST	5*	W90-023 7: tread—treat—trest—trast
CARDS—DEALT	5, 6	W90-023 6: carls—calls—cells—dells—deals—DEALT—deals—deads—heads—herds—hards
CARVE—ROAST	5*	W90-023 7: carse—corse—coase—coast—ROAST—roase—coase—corse—carse
CHEEK—JOWLS	5, 7	W90-023 8: check—chack—chalk—chals (vf)—coals—cowls—JOWLS—cowls—cowes (vf)—cower—coyer—chyer—cheer
COSTS—PENCE	5*	Carroll 10, W89-224 7: posts—pests—pents—pente—PENCE—pente—peste—ceste—coste
DAISY—CHAIN	5, 7	dairy—dairt—cairt—chirt—chart—charn—CHAIN—chait?—chart—chirt—cairt—dairt—dairy
DAISY—WHITE	4*	daise—waize—waite
DOUGH—BREAD	5, 7	W90-025 9: bough—bouge—boune—brune—brene—brend—BREAD—dread—dreid—dreih—dreggh—draggh—doagh
DOUGH—TOAST	4, 5	tough—toogh—toosh—toost—TOAST—toust—loust—loush—lough
EIGHT—BELLS	5, 6	bight—bigot—bigos—bilos—bills
FAIRY—QUEEN	5, 7	faird—baird—bairn—buirn—quirn—quern—QUEEN—quern—quere—huere—huire—haire—faire
FLOUR—BREAD	5*	Carroll 6: fleur—flear—blear—blead—BREAD—blead—flead—flear—fleur
FLOUR—DOUGH	5, 7	W90-025 13: flouh—flogh—fligh—bligh—boigh—bough—DOUGH—pough—pouch—pluch—ploch—plouh—flouh
FLOUR—TOAST	5, 6	clour—clout—claut—clast—coast—TOAST—toost—goost—glost—glout—flout
FUNKY—DYKES	5*	W90-022 5: funks—dunks—dunes—dynes
GAMBA—CELLO	5*	W90-023 7: gamla—galla—calla—callo—CELLO—cella—calla—galla—gamla
GRASS—GREEN	3*	Carroll 8, W89-224 4: gress—grees
GUTSY—TIMID	5, 9	W90-023 9: gutty—cutty—cutey—cuter—citer—titer—timer—timed—TIMID—tumid—fumid—fumed—fumee—fusee—fusse—fussy—gussy
KINKY—LOVER	5*	W90-022 5: linky—liney—liner—liver—LOVER—loner—liner—liney—linky
LAGER—LOUTS	4, 5	loger (vf)—loges—logis—louis
LAGER—STOUT	5, 7	W90-023 9: layer—sayer—shyer—shoer—shour—stour—STOUT—strut—stret—saret (Algeria, EB)—baret—barer—bager
LAMBS—BONED	5*	W90-022 5: lames—lanes—banes—bones—BONED—baned—banes—lanes—lames
MACHO—PUNKS	5*	W90-022 5: machs—macks—packs—pucks—PUNKS—pucks—mucks—macks—machs
NANNY—GOATS	5, 6	nonny—nouny—nouns—nouts—gouts—GOATS—goans—goana—gonna—gonny—nonny
PAPER—TYPED	3*	W90-023 3: taper—taped—TYPED—typer—taper
PITCH—TENTS	5*	Carroll 6: pinch—pench—tench—tenth—TENTS—pents?—pints—pitts?—pitth
PUSSY—TIGER	5, 6	W90-023 9: pusey—puney—tuney—tuner—tiner—TIGER—tiner—piner—piney—puney—pusey

QUELL—BRAVO	5, 7	Carroll 11, W89-224 10: quall—gual—gual—grale—grave—brave
QUILT—SHEET	4*	Carroll 14, W89-224 7: quelt—suelt—shelt
RIVER—SHORE	5, 7	Carroll 11, W89-224 8: rover—cover—cooer—cooe—coore—soore—SHORE—shorr—shoer—shyer—sayer—saver—raver
ROUGE—CHEEK	5, 7	Carroll 17, W89-224 11: rouse—couse—chuse—chese—chess—chees—CHEEK—cheet—chett—chete—chute—coute—route
ROUGE—WHITE	4*	route—woute—whute
SANTA—CLAUS	5, 6	sante—saate—slate—clate—clats—CLAUS—clats—cluts—sluts—sauts—sants
SEVEN—EIGHT	5, 6	W68-026 11, W90-023 9: reven—revet—reget—riget—right
SHEEP—CLIPT	5*	W90-022 5: sheet—sleet—slept—slipt—CLIPT—clept—cleet—cheet—cheep
SKIRT—PANTS	5, 6	W90-023 7: skint—saint—paint—pains—pait (vf)—PANTS—pait (vf)—pairs—sairs (vf)—shirs (vf)—shirt!
STAMP—ALBUM	5, 8	slamp—slaep (vf)—slaes (vf)—sloes—aloes—albes (vf)—albus
STEAL—COINS	5, 6	Carroll 8: stell—soell—soill—soils—coils—COINS—chins—chias—cheas—sheas—sheal
THREE—SIXTY	5, 6	W90-023 11: shree—saree—sarte—saxe—sixte
TOXIC—WASTE	5, 7	W90-023 8: loxic—loric—lorie—worie—wosie—woste—WASTE—taste—tarte—torte—torti—torii—toric
WHALE—BONES	5, 7	W90-023 8: shale—soale—boale—bowle—bowls—bowes—BONES—boles—bolls—bolle—boale—soale—shale
WHEAT—BREAD	3, 4	Carroll 7, W89-224 6: theat—treat—tread—BREAD—gread—great—wreat
WHEAT—DOUGH	5, 6	sheat—sheah—shegh—shugh—sough
WHEAT—FLOUR	5, 6	W90-025 7: cheat—cleat—flea—float—flout—FLOUR—fleur—flear—clear—cleat—cheat
WHEAT—TOAST	4, 5	cheat—chest—chast—coast—TOAST—trast—wrast—wrest—whest
WHITE—HOUSE	4*	W92-212 4: whute—woute—houte
WITCH—FAIRY	5, 7	Carroll 13, W89-224 7: watch—latch—laich—laics—lairs—fairs—FAIRY—farry—parry—parcy—parch—patch—pitch
ACORNS—SOAKED	6*	W88-104 6: scorns—scores—scars—scared—soared
ANUSES—CRIMPY	6*	W88-104 6: anises—arises—crises—crimes—crimps—CRIMPY—crispy—crisps...
BANTER—WHINNY	6*	W88-104 6: baiter—waiter—whiter—whiner—whiney—WHINNY—whiney—whitey etc
BLONDE—CHICKS	6*	W90-022 6: blonds—blinds—blinks—clinks—clicks—CHICKS—chinks—clinks—blinks—blinds—blonds
BRAZEN—HUSSEY	5, 8	crazen—crazes—crases—ceases—cesses—cusses—husses (dogfish)—HUSSEY (vf)—husses—busses—bosses—booses—broses—brosen—brasen
BREAST—STROKE	6, 9	creast—crease—creave—cleave—cleake—sleake—steake—strake—STROKE—strove—strave—steave—sleave—cleave—creave—crease—creast
CHOKER—PRIZES	5, 6	Carroll 10, W89-224 7: chomer—chimer—chimes—crimes—primes—PRIZES—prises—priser—proser—croser—croker
DARWIN—BEAGLE	6, 8/9	(8 if BEATIE?): darwan—durwan—durgan—durgen—burgen—burgee—burgle—bergle—BEAGLE—beatle—beatee—bettee—Bettie—Bertie—bertin—bar-tin—barwin
DARWIN—MONKEY	6, 9	barwin—bar-tin—martin—maltin—malkin—mankin—manken—mankey—MONKEY—mankey—mankes—mantes—martes—marten—martin—bar-tin—barwin
DISHES—WASHED	3*	W90-023 3: dished—dashed—WASHED—wished—wishes
FALLEN—LEAVES	5, 6	W90-024 7: fellen—dellen—delles—delves—deaves
GIGGLY—SUDDEN	6, 9	W73-160 30: giggle—guggle—gurgle—gurdle—curdle—cuddle—cuddee—cudden—SUDDEN—sadden—sadder—gadder—gadger—gagger—gaggee—gaggle—giggle (original was probably the longest minimum-length path in MWPD for 6-letter words: giggle—wiggle—waggle—wangle—mangle—mantle—cantle—cattle—battle—bottle—mottle—mettle—settle—settee—setter—better—batter—banter—banker—tanker—tinker—winker—winder—binder—bidder—bidden—midden—madden—sadden)

GRAVID—MOTHER	6, 8	W90-024 9: graved—craved—crated—coated—cotted—motted—mothed
GUNMEN—JAILED	5, 7	W90-024 8: gunnen—gunned—runned—ruined—rained—railed—JAILED— jailer—gailer—gainer—ganner—gannen—gunnen
GUNMEN—GAOLED	5, 7	gunnen—gunner—ganner—gainer—gailer—gaoler—GAOLED—gaoler—gailer— gainer—ganner—gannen—gunnen
KAISER—PORKER	4*	Dudeney 11, W89-226 8: paizer (EDD)—parser—parker
KETTLE—HOLDER	6, 7	Carroll 10, W89-225 8: settle—settee—setter—hetter—helter—helder— HOLDER—holter—hotter—hetter—setter—settee—settle
MONKEY—PUZZLE	6, 7	Monkee (TV pop group member)—monkie—monzie—mozzie—muzzle—muzzle
PAPERS—GRADED	6, 10	W90-024 10: capers—copers—cooers—cooees—cooeed—cooled—coaled— goaled—goaded
PICKED—BALLOT	6*	W88-104 6: packed—backed—balked—balled—ballet
PURPLE—YELLOW	6, 10	W90-024 25: pumple—pumpee—pumped—pulped—pulled—pilled—pillow— pillow—pellow—YELLOW—pellow—pullo—pullon—pullen—pulled— pulped—pumped—pumpee—pumple
ROOKIE—GOOFED	4, 6	W90-024 7: cookie—cookee—cooker—coofer—goofer—GOOFED—roofed— rooked—cooked—cookee—cookie
SPRING—SUMMER	6, 7	W90-024 12: sering—serins—series—semies (vf)—semmes (vf)—semmer
SNORTS—WHISKY	6*	W90-022 6: shorts—shirts—shists—whists—whisks
TARTAN—BLAZER	6, 7	W90-024 10: tartar—tarter—terter—teater—beater—beazer—BLAZER— beazer—teazer—teater—terter—tarter—tartar
TARZAN—JUNGLE	6, 9	W90-024 11: tarman—barman—barmen—bargen—bargee—burgee—bungee— bungle—JUNGLE—jangle—mangle—mantle—mantoe—manton—tanton— tantan—tartan
VALISE—PACKED	5, 8	W90-024 13: malise—malist—marist—mariet—market—marked—parked
WEAVER—BASKET	5, 6	Espy 8, W89-226 7: beaver—beaker—becker—backer—bucket—BASKET— basker—baster—bester—beater—beaver
WHACKY—STYLES	6*	W90-022 6: whacks—shacks—stacks—stalks—stales—STYLES—stales— stalks—stacks—shacks—shacky
WINTER—SPRING	6, 9	W90-024 9: winier—wirier—airier—aerier—eries—series—serins—sering— SPRING—soring—coring—coning—conins—conies—contes—conter—cinter
YUPPIE—RICHES	6, 9	W90-024 10: yippie—yippee—tippee—tipree—titree—titres—tithes—tiches— RICHES—wiches—wishes—wished—wisped—wipped—yipped—yippee—yippie
BANDITS—GALLOWS	5, 10	W90-024 13: bandies—bundies—burdies—burlies—bullies—bulloes—hulloes— halloes—hallows
BANNERS—SETTLER	7*	W79-154 7: banter—batters—betters—setters—settees—settles
BANKERS—SETTLED	7*	W90-155 7: banter—batters—betters—setters—settees—settles
BLOCKED—CHANGES	6*	W90-155 6: blacked—blinked—clanked—clanged—changed
CHICKEN—LOBSTER	6, 8	W90-156 15: chicker—whicker—whisker—whister—waister—wabster—wobster
CHICKEN—PLUCKED	4, 5	W90-156 8: chicker—chucker—chucked—clucked—PLUCKED—clucked— clicked—clicker—chicker
COSTARS—BRAVELY	7*	W90-155 7: costers—coaters—craters—cravers—bravers—bravery
CRITTUR—FLUSHED	7*	W90-024 7: critter—fritter—flitter—flutter—fluster—flusher—FLUSHED— flusher—fluther—cluther—clutter—clitter—critter
DOOLIES—GURNEYS	6, 10	W90-024 12: doilies—dailies—bailies—bailees—baileys—barleys—barneys— carneys—curneys—GURNEYS—gurnets—gurllets—gullets—gullers—pullers— pollers—pollees—pollies (Austral = politician, see polly, OED)—dollies
DROPPED—CLASSES	6*	W90-024 6: cropped—clopped—clapped—clasped—classed
FELLOWS—GIRLIES	5*	W90-155 5: felloes—fellies—fillies—gillies
KEISTER—SPANKED	6, 8	W90-156 12: geister—glister—glinter—slinker—slinked—spinked
KNOCKED—SHARPLY	7*	W90-155 7: knacked—snacked—shacked—sharked—sharped—sharpey— SHARPLY—sharpey—sharkey etc
PICKING—PEACHES	6, 14	W90-024 16: pocking—polking—polting—posting—postins—posties—potties— pottier—poutier—pouter—poucher—poacher—peacher—PEACHES— (snake same but pouches—poaches in place of last two)
PISTOLS—MARRIED	7*	W90-155 pistils—pastils—pasties—parties—partied—parried—MARRIED— marries—parries etc

PLAYERS—SETTLED 7*	platers—slaters—seaters—setters—settees—settles
SETTLES—BRAVERY 7*	W90-155 7: settees—setters—betters—beaters—beavers—bravers—BRAVERY—beavery etc
SINNERS—CONFESS 4, 5	W90-155 5: tinnors—tonners—conners—confers
TEACHER—CHICKEN 5*	(in the Bronx?): thacher—thacker—thicker—thicken—CHICKEN—chicker—chacker etc
TRIOLET—RONDELS 7, 17	W90-024 28: trillet—trilles—tailles—pailles—paidles—paddles—paddies—pandies—panties—punties—puntees—punters—punners—runners—runnels—ronnels
WOUNDED—DOOLIES	5, 6 W90-024 22: wounder—woonder—woolder—woolier—woolies
Word Ways	
WORD—WAYS 3*	W91-045 3: ward—wars—WAYS—woys—woyd
GRANT—NEWBY 5, 6	(Jeff to Peter): geant—geast—neast—newst—newsy
GORDON—THORPE 6, 12	(Leonard to Susan): cordon—corden—corded—corned—sorned—sornee—soonee—shonee—shonne—thonne—thorne—THORPE—thorne—therne—wherne—weerne—weerie—werrie—warrie—warrin—wardin—gardin—gardon

Political

... describing possible outcomes of the 1997 UK General election, and the years following. The incumbent Prime Minister was John Major, and his opponent is Tony Blair.

MAJOR—BLAIR 4, 8	mayor—mayer—bayer—bauer—bluer—bleer—bleir—BLAIR—bleir—bleer—bluer—bauer—bager—mager—magor
MAJOR—MINOR 2*	Prime Minister to become Leader of the Opposition?: manor—menor
BLAIR—CHAOS 4*	clair—chair—chais—CHAOS—chais—clais—clair
CHAOS—MAJOR 4, 8	chats—coats—moats—monts—monos—mojos—majos—MAJOR—majos—maros—maris—saris—shris—chris—chais

Long examples (8 letters or more)

BERTHING—QUIRKING 5, 17	W90-155 25 (original was longest minimum path for 8-letter words in augmented OSPD): beathing—beatling—bratling—cratling—critling—chitling—chilling—shilling—shelling—swelling—dwelling—duelling—quelling—quilling—quilting—quirting
CHANTORS—SNIPPETY 8, 14	W90-156 15: chanters—chatters—clatters—platters—plasters—plashers—clashers—claspers—clappers—clippers—slippers—slippery—snippety—SNIPPETY—snippety—snappery—snappers—slappers—clappers—claspers—clashers—plashers—plasters—platters—clatters—chatters—chanters
CREATIVE—WHACKING 7*	W88-104 7: creatine—creating—creaking—wreaking—wrecking—wracking
DALLYING—TATOOING 5, 20	W95-198 22: dallying—dollying—jollying—jellying—bellying—belaying—relaying—resaying—resawing—resowing—resoling—restling—mestling—mastling—mastring—masering—taserling—tabering—taboring—tabooing
DEAFNESS—RURALITY 8, 45	span of 8-letter words W95-198 73: dearness—nearness—neatness—featness—featless—beatless—beamless—teamless—tramless—trampess—trampers—crampers—crimpers—crispers—crispens—crispins—crisping—grisping—grasping—grassing—brassing—braising—brailing—broiling—brokling—bookling—boodling—doodling—dodding—diddling—middling—meddling—medaling—metaling—metaline—metalise—metalist—medalist—modalist—moralist—muralist—ruralist—ruralise—ruralite
DIGESTOR—REVERSED 7*	W90-156: digester—digested—divested—devested—revested—reverted
GESTATES—RAVELLED 7*	W88-104 7: gestated—restated—reseated—resealed—revealed—revelled
HEDGIEST—HAPPIEST 3, 15	W95-199 19 (not given): hedgiest—ledgiest—loggiest—boggiest—buggiest—puggiest—pudgiest—pudsiest—pussiest—mussiest—massiest—gassiest—gaspiest?—gappiest
HOLDINGS—OUTMODED 8, 14	W95-199 20 (not given): hildings—wildings—willings—wallings—callings—catlings—cutlings—cutlines—outlines—outlined—outlived—outloved—outmoved
REMITTOR—DESANDED 7*	W90-156 7: remitter—remitted—reminted—reminded—remanded—demanded

REVERSOS—DIGESTED	7*	W90-156 7: reverses—reversed—reverted—revested—divested—divested
SHIPONS—CLAMBERD	8*	W79-154 8: shippens—shippers—slippers—clippers—clappers—clampers—clambers—CLAMBERD—(chippers instead of slippers)
SNOBBERY—PLUMPENS	7*	W90-156 7: slobbery—slobbers—slubbers—slumbers—plumbers—plumpers
SOUTHERN—PLANTERS	6, 9	W90-156 12: southers—soothers—smothers—smithers—slithers—slathers—slatters—platters
THUMBING—CRAPPOES	8*	W88-103: thumping—trumping—tramping—trapping—crapping—crappins—crappies—CRAPPOES—crappies—crappins—crapping—chapping—champing—chumping—thumping
UNRUINED—EXPENSES	7, 19	W95-199 20: unreined—unveined—unveiled—unceiled—uncoiled—untoiled—untolled—untilled—untitled—untinted—untented—untended—untender—entender—extender—expender—expended—expensed
WITCHERY—LYNCHERS	4, 6	W90-156 10: pitchery—pitchers—pinchers—punchers—lunchers

Please refer to W95-197ff. for the details of the following 15 ladders, which Leonard Gordon reported as being the only ideal ladders for 8-letter words in his vocabulary (plus a non-ideal ladder of length 9). Some variations (snakes) exist for those marked:

CRAMPITS—SLOBBERY†/BLUBBERY†	CRISPERS—PLUMBING/THUMBING
CRAPPOES—THUMBING† (see above) /SLUMMING†/FLUSHING/SHILLING/SHIRKING	UNTESTED—EXPANDOR
UPRUSHED—INVENTOR†/INVERTOR	CARLINGS/OUTMOVED† (and similar)
CARPINGS/OUTLOVED†	
UNPAUSING—UNDERLOUT	

CANCERATE—BUTTONING 9* MAD: cancerite—cancerine—cancering—cantering—bantering—battering—battening—battoning—BUTTONING
(CANCERITE is in Web1 (1870), and CANCERINE is in Webster New Int Dict 1932)

Howard Richler: The Ascent of Man (W91-124)

MAN—mat—oat—opt—apt—APE—are—arm—aim—dim—dig—DOG—dot—cot—CAT—RAT—BAT—bit—ait—ANT
(shorter: MAN—mae/aan—aae?—APE and APE—(aye—dye or aie—die)—doe—DOG)

Stepladders

MILD—NINE 4* W89-180 4: mile—mime—mine
see also W89-239/240 and W91-115

In W92-016, Leonard Gordon proposes replacing letters by ones six places distant (allowing wrap-around past Z), eg haze—hate—bate

Other examples

IVY—YOU	3*	W85-2179: yvy—yoy
ABAC—WORD	4, 6	W69-062 12: abad—arad—trad—toad—woad—WORD—sord—serd—sead—seac—aeac
DRIP—PICK	4, 6	deip—deep—deek—deck—dick—PICK—pack—pace—paie—prie—drie (and 24 others)
FOOL—MULE	4*	W90-022 4: mool—moll—mull—MULE—mole—mooe—mool
HERE—THEN	4*	W90-022 4: hern—tern—teen—THEN—thee—thre—tere
HOGS—LARD	4*	W90-022 4: hags—lags—lars—LARD—lord—lors—hors
INCH—AMYL	4, 6	W90-154 14 (longest minimum length ladder in OSPD): isch—asch—asah—amah—amal—AMYL—acyl—accl?—acca—anca?—inca
INCH—ISLE	3, 4	was the span of 4-letter words WW Feb 89 14: insh?—issh—isse
INCH—ORLE	4, 6	was the span of 4-letter words WW Feb 89 14: ench—erch—ersh—erse—erle
MULE—HERD	4*	W90-022 4: mure—mere—here—HERD—held—meld—mele
BONNY—TIMES	5*	W90-022 5: boney—bones—tones—tines—TIMES—tomes—tones—bones—boney
FUNNY—BIRDS	5*	W90-022 5: bunny—bunns—bunds—binds—BIRDS—birdy—birny—binny—bunny

HELLO—WORDS	5*	W90-022 5: hells—wells—welds—wolds
JENRO—IDLER	5, 10	was the span of 5-letter words WW Feb 89: genro—genio—genie—venie—venee—vened—veled—ieled—idled
MUSTY—HOUSE	5*	W90-022 5: mussy—mossy—mousy—mouse—HOUSE—hosse—mosse—mossy—mussy
TIGER—BONED	4*	tinier—toner—toned—BONED—boner—toner—tinier
TIGER—LAMBS	5*	W90-022 5: timer—tamer—tames—lames—LAMBS—limbs—limes—limer—liger
BLOODY—DREAMS	6*	W90-022 6: bloods—broods—broads—breads—dreads—DREAMS—breams—breads—broads—broods—bloods
BRAVER—SETTLE	6*	W88-103 6: beaver—beater—better—setter—settee—SETTLE—settee—bettee—beatee—beater—beaver
BRAZEN—CHORUS	6*	W90-022 6: brazes—crazes—crozes—crores—chores—CHORUS—chores—chares—crares—crazes—brazes
CHARAS—HOOKED	6*	W90-022 6: chares—chores—chokes—choked—cooked—HOOKED—cooked—choked—chored—chared—chares
CLUMPY—PASSES	6*	W88-104 6: clumps—plumps—plumes—pluses—pauses
CODGER—TENNIS	6*	W90-022 6: conger—conner—tonner—tonnes—tennes—TENNIS—tennes—tenner—tonner—conner—conger
CURIOS—WANTED	6*	W90-022 6: curies—caries—cartes—carted—warted—WANTED—canted—carted—caried—caries—curies
MISSUS—WANTED	6*	W90-022 6: misses—masses—massed—masted—wasted—WANTED—wasted—wisted—misted—missed—misses
PAINCH—DEGAGE	6, 11	was the span of 6-letter words WW Feb 89: 44: paunch—paunce—pauice—palice—pelice—delice—delace—deface—defame—degame
PASTAS—MOTHER	6*	W90-022 6: pastes—paster—poster—potter—pother—MOTHER—mather—masher—mashes—pashes—pashas
ROCKET—HANGAR	6*	W90-022 6: rocker—hocker—honker—hanker—hanger—HANGAR—hanger—ranger—ranker—racker—racket
STONED—CHARAS	6*	W90-022 6: stored—stores—stares—shares—chares—CHARAS—chares—chores—shores—stores—stones
ANLAGEN—CABARET	5, 28	W90-154 59 (see original for details - longest minimum-length path for 7-letter words in augmented OSPD): anlages—anlaces—unlaces—unlaced—unfaced—unfaked—uncaked—uncakes—uncases—uneases—ureases—creases—cresses—chesses—chesser—chester—thester—thister—taister—tapster—tapiter—tapicer—tapecer—taperer—taberer—taberet—tabaret
BOOTEES—RUBBING	7*	W88-104 7: booties—boobies—bobbies—bobbins—bobbing—robbing—RUBBING—bubbing etc
BRUSHES—PLANTAR	7*	W88-104 7 blushes—blusher—bluster—blaster—plaster—planter—PLANTAR—planter—plaster—plasher—plashes—blashes—blushes
BUTTERY—PARRIES	7*	W79-154 7: butters—putters—puttees—putties—patties—parties—PARRIES—patries etc
CANNONS—MYSTERY	7*	W88-103 7: cantons—cantors—canters—casters—masters—mastery
CAREENS—TEMPURA	7*	W88-104 7: careers—carpers—campers—tampers—tempers—tempera
CHANTRY—SWITHER	7*	W88-104 7: chantey—chanter—chatter—shatter—swatter—swather—SWITHER—switter etc
CONDOMS—BATTERY	7*	W90-155 7: condors—candors—cantors—canters—banters—batters—BATTERY—bantery etc
CUSTARD—MOPPETS	7*	W90-155 7: costard—costars—costers—copters—coppers—moppers
CUTLERY—PANTIES	7*	W88-104 7: cutlers—cutters—putters—puttees—putties—patties
DIVISOR—RESOLED	7*	W88-104 7: devisor—revisor—reviser—revised—reviled—resiled—RESOLED—resiled—reviled—deviled—deviler—deviser—devisor
JUNKIES—PATTERN	7*	W90-155 7: punkies—punties—putties—puttees—putters—patters—PATTERN—patters—putters—punter—puntees—punties—punkies
LONGING—PARTING	4*	MAD 94 17 (OSPD span): panting—panging—langing—LONGING—ponging—porging—parging

MARTELS—PITHING 7*	W76-212 7: martens—martins—mattins—matting—patting—pitting—PITHING— pathing—patting—matting—marting—martins—martens
METALED—SISTERS 7*	W88-104 7: mettled—settled—settles—settees—setters—sitters—SISTERS— sitters—setters—settees—settles—mettles—mettled
POSTMEN—BANKERS	7* W90-155 7: posteen—postern—pastern—pasters—busters—bansters
SNOWMAN—CLIPPED 7, 8	W90-155 9: showman—shopman—shipman—shipmen—shippen—shipped— chipped—CLIPPED—slipped etc
SNOWMEN—CLIPPER 6, 7	W90-155 7: showmen—shopmen—shipmen—shippen—shipper—(whipper)— chipper—CLIPPER—slipper etc

Joined ladders

The above examples contain many examples of a common word ending one ladder, and starting another, eg FOOL—MULE—HERD, DEVIL—ANGEL—DEMON, JAILED—GUNMEN—GOALED, STONED—CHARAS—HOOKED, and WOUNDED—DOOLIES—GURNEYS. The next section gives longer examples.

Complete graphs

Every word in a sequence is joined to every other word (see above for the individual ladders). For n words, $n(n-1)/2$ ladders are required.

DRIP—NOSE—PICK (3 ladders)

LEAD—GOLD—IRON (3 ladders)

SPRING—SUMMER—WINTER (3 ladders)

TIGER—BONED—LAMB (3 ladders)

INCH—FOOT—YARD—MILE (6 ladders)

WHEAT—FLOUR—DOUGH—BREAD—TOAST (10 ladders)